2′-HYDROXYINDAN-1′-YL ACETIC AND MALONIC ACIDS

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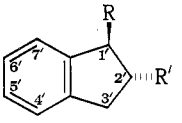
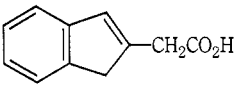
The reaction of 2-bromo-1-hydroxyindane with the sodio derivative of diethyl malonate or ethyl acetoacetate has been reported to yield *trans*-1′-hydroxyindan-2′-yl-malonic (1a) and -acetic (1b) acids respectively.[1] Dehydration of (1b) was reported to give inden-2′-ylacetic acid (3) although it was later noted that its melting point differed from that of authentic inden-2′-ylacetic acid.[2]



	R	R′
(1a)	OH	$CH(CO_2H)_2$
(1b)	OH	CH_2CO_2H
(2a)	$CH(CO_2H)_2$	OH
(2b)	CH_2CO_2H	OH



(3)

We have repeated the preparations of the compounds reported by Peacock and Menon[1] and now present evidence to show that these compounds are in fact the 2-hydroxy-1-substituted indanes.

The structure of 2-bromo-1-hydroxyindane was confirmed by its n.m.r. spectrum in $(CD_3)_2SO$, the significant feature being a doublet of doublets at δ 5·13 p.p.m., attributed to H 1, which collapsed to a doublet following deuterium oxide exchange of the adjacent hydroxyl proton.

Substitution of the malonyl group in the malonylhydroxyindane is shown to be at C 1′ (2a) rather than at C 2′ (1a) by the appearance in the n.m.r. spectrum of a doublet of doublets, δ 3·46 p.p.m., for H 1′ and a multiplet, δ 4·29 p.p.m., for H 2′. Had substitution of the malonyl group occurred at C 2′ then the proton on the carbon carrying the hydroxyl group would have appeared as a doublet instead of a multiplet. The side-chain methine proton is observed as a doublet, δ 3·31 p.p.m.

Double irradiation of the multiplet assigned to H 2′ reduces the H 1′ signal to a doublet, is without effect on the malonyl methine proton, and collapses the two doublets of doublets, δ 2·60 and 3·10 p.p.m., assigned to the geminal C 3′ protons to doublets. Hence nucleophilic substitution must have occurred at C 1′.

The *trans*-configuration of 2′-hydroxyindan-1′-ylmalonic acid (2a) as reported by Peacock and Menon[1] (but with the substituents reversed) is confirmed by the coupling constants $J_{1',2'}$, $J_{2',3'a}$, and $J_{2',3'b}$ of 3·0, 3·5, and 6·0 Hz respectively.

The n.m.r. spectrum of *trans*-2′-hydroxyindan-1′-ylacetic acid (2b) is consistent with the revised substitution but the *trans*-configuration is not confirmed by the coupling constants. A fortuitous similarity of these, $J_{1',2'} = 6{\cdot}4$ Hz, $J_{2',3'a} = 6{\cdot}0$ Hz, and $J_{2',3'b} = 6{\cdot}1$ Hz, leads to the appearance of quartets for H 1′ and H 2′ at δ 3·91

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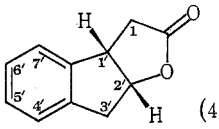
[1] Peacock, D. H., and Menon, B. K., *J. chem. Soc.*, 1934, 1296.

[2] Bergmann, E. D., and Hoffmann, E., *J. org. Chem.*, 1961, **26**, 3555.

and 4·63 p.p.m. respectively. The *trans*-configuration is consistent, however, with the results of Peacock and Menon[1] who reported the slow formation of *cis*-2′-hydroxyindan-1′-ylacetic acid lactone (4) on treatment of the *trans*-hydroxy acid with HBr in acetic acid but that after being dissolved in sodium hydroxide solution the *cis*-lactone was rapidly regenerated on acidification.



(4)

The n.m.r. spectrum of *cis*-2′-hydroxyindan-1′-ylacetic acid lactone (4) is consistent with the proposed structure, the H 1′ signal being observed as a doublet of triplets, δ 5·24 p.p.m., and the H 2 signal as an eight-line multiplet, δ 3·96 p.p.m.

The substitution of the malonyl group at C 1 rather than at C 2 of the indane nucleus can be explained by a facile elimination of HBr from 2-bromo-1-hydroxyindane in the basic reaction medium to yield the epoxide; nucleophilic attack of the malonyl carbanion at the benzylic carbon of the epoxide would then give the observed product. Such a shift of the hydroxyl group has been observed when ammonia or amines react with 2-bromo-1-hydroxyindane[3] and a similar epoxide intermediate has been postulated for the synthesis of a 2′-hydroxytetralinmalonic acid from 2-bromo-1-hydroxytetralin and sodio diethyl malonate.[4]

Experimental

Microanalyses were carried out by the Australian Microanalytical Service, Melbourne. Melting points were determined on the Kofler heating stage. The infrared absorption spectra were recorded with a Unicam SP200 spectrometer. The n.m.r. spectra were recorded with a Varian HA-100 spectrometer operating at 100 MHz and all chemical shifts are reported relative to tetramethylsilane as an internal standard.

trans-*2′-Hydroxyindan-1′-ylmalonic Acid* (*2a*)

The compound was prepared according to the method of Peacock and Menon,[1] m.p. 118–119° (lit.[1] 1-hydroxy isomer, m.p. 118°). ν_{max}: 3500 (OH), 2700 and 2600 (COOH), and 1740 and 1725 cm^{-1} (C=O). N.m.r. ($(CD_3)_2SO$; δ p.p.m.): H 3′a, 2·60 ($J_{2',3'a}$ 3·5, $J_{3'a,3'b}$ 16·0); H 3′b, 3·10 ($J_{2',3'b}$ 6·0); H 1, 3·31 ($J_{1,1'}$ 8·5); H 1, 3·46 ($J_{1',2'}$ 3·0); H 2′, 4·29; H 4′, H 5′, H 6′, and H 7′, 7·08.

trans-*2′-Hydroxyindan-1′-ylacetic Acid* (*2b*)

(A) The compound was prepared from 2-bromo-1-hydroxyindane and sodio ethyl acetoacetate,[1] m.p. 131–132° (lit.[1] 1-hydroxy isomer, m.p. 131°) (Found: C, 68·7; H, 6·4. Calc. for $C_{11}H_{12}O_3$: C, 68·7; H, 6·3%). ν_{max}: 3350 (OH), 2650 (COOH), and 1690 cm^{-1} (C=O). N.m.r. (C_5D_5N; δ p.p.m.): 1-CH_2, 2·95 ($J_{1,1'}$ 6·8); H 3′a, 3·07 ($J_{2',3'a}$ 6·0, $J_{3'a,3'b}$ 15·8); H 3′b, 3·34 ($J_{2',3'b}$ 6·1); H 1′, 3·91 ($J_{1',2'}$ 6·4); H 2′, 4·63. H 4′, H 5′, H 6′, and H 7′ were observed as a singlet at δ 7·23 p.p.m. in $(CD_3)_2SO$.

(B) *trans*-2′-Hydroxyindan-1′-ylmalonic acid (2a) was heated at 150° for 15 min and the residue was crystallized from benzene–acetone,[1] m.p. and mixed m.p. with material from (A), 130–131°. The n.m.r. spectrum was identical with that from (A).

cis-*2′-Hydroxyindan-1′-ylacetic Acid Lactone* (*4*)

The compound was prepared according to the method of Peacock and Menon,[1] m.p. 73–74° (lit.[1] 1-hydroxy isomer, m.p. 73°) (Found: C, 75·7; H, 5·6. Calc. for $C_{11}H_{10}O_2$: C, 75·8; H, 5·8%). ν_{max}: 1760 cm^{-1} (C=O). N.m.r. ($CDCl_3$; δ p.p.m.): H 3′a, 2·66 ($J_{2',3'a}$ 2·0, $J_{3'a,3'b}$ 18·0); H 3′b, 3·01 ($J_{2'a,3'b}$ 8·5); 1-CH_2, 3·27 ($J_{1,1'}$ 3·0); H 2′, 3·96 ($J_{1',2'}$ 6·0); H 1′, 5·24; H 4′, H 5′, H 6′, and H 7′, 7·21.

[3] Von Braun, J., and Weissbach, K., *Ber. dt. chem. Ges.*, 1930, **63**, 3052.

[4] Van Tamelen, E. E., Van Zyl, G., and Zuidema, G. D., *J. Am. chem. Soc.*, 1950, **72**, 488.